

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#1/A. EVANS
D. EVANS
6-15-02
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TECHNOLOGY CENTER 2800

In re Application of:

Yasuaki Seki et al.

Serial No.: 09/537,083

Filed: March 29, 2000

For: PRINTED CIRCUIT BOARD AND
MANUFACTURING METHOD OF THE
PRINTED CIRCUIT BOARD

Art Unit: 2827

Examiner: J. Norris

Atty Docket: 21994/005

RESPONSE AND AMENDMENT UNDER 37 CFR § 1.111

Commissioner for Patents
Washington, D.C. 20231

Sir:

In response to the Office Action dated March 13, 2002, please amend the above identified application as follows:

IN THE DRAWINGS:

The Examiner's approval is sought for the attached changes to the cross hatching shown in red on the drawings, as required by the Examiner. The Examiner's further requirement that the drawings show more than two kinds of organic resins is believed to be in error as will be discussed in the Remarks.

IN THE SPECIFICATION:

Page 10, line 6- page 11, line 6 is amended to read:

AI
Currently, a carbon dioxide laser beam is commonly utilized for perforating the hole for connection. However, processing an area of less than 50 μm is hardly feasible because a wave length of the laser beam is approximately 10 μm , which is rather long, so that a spot of the laser beam can hardly be focused. Since residue of resin remains in approximately 1 μm thick after the laser processing, the residue must be removed by such a method as de-smearing. According to the present invention, a YAG (yttrium aluminum garnet) laser having a wave length of 400 to 600 nm is utilized for perforating the hole for connection, so that resin residue can be eliminated in conjunction with focusing a laser spot in an extremely small diameter. In the case of the carbon dioxide laser beam, an absorption ratio of copper to a laser beam is less than 10%, so that most of the laser beam is reflected on the surface of the insulative layer and not abrade into the insulative layer. Accordingly, the laser beam generates heat and melts surrounding resin, so that the melted resin remains in film. On the other hand, in the case of the YAG laser beam having the wave length of 400 to 600 nm, an absorption ratio of copper to the YAG laser beam is from 20 to 55 %, copper is abraded properly, so that the resin residue does not remain. Accordingly, the process of de-smearing is not necessary. If a wave length of a laser beam is smaller than 400 nm, an absorption ratio of copper increases and the circuit pattern may be perforated as deep as some μm due to excess abrasion. Therefore, in a case where a thickness of copper becomes thinner in accordance with being a circuit pattern made finer in the near future, a laser processing by using the wave length of less than 400 nm is harmful for copper of a circuit pattern because the copper is shaved too thin.

IN THE CLAIMS:

Kindly cancel claims 2-4, without prejudice or disclaimer.

Kindly amend claim 1 as follows:

1. (Amended) A printed circuit board comprising:
- a circuit pattern formed on a surface of a base substrate, the surface at least comprising an insulative material;
 - an insulative layer formed over the surface of said base substrate and including said circuit pattern, the insulative layer comprising a mixed insulative material of more than two kinds of organic resins having different etching rates during a dry etching process;
 - a connection hole perforating said insulative layer;
 - a conductive film forming an electroplating foundation, electroplating formed on the surface of said insulative layer by a vacuum film forming process after roughing the surface of said insulative layer by removing a part of the surface of said insulative layer with a dry etching process; and
 - a conductive layer formed over said conductive film by an electroplating process;
- wherein said conductive layer is connected with said circuit pattern electrically.
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REMARKS

The Office Action has been carefully considered. To expedite the prosecution, claim 1 has been amended to avoid further rejection under 35 U.S.C. § 112. Further, drawing changes are submitted for the Examiner's approval in accordance with his requirement on page 2 of the Office Action.

The Examiner rejected claim 1 under 35 U.S.C. § 112, first paragraph, as containing subject matter not adequately disclosed in the specification. Specifically, the Examiner questions the support for an insulative material of more than two kinds of organic resins.

In accordance with the invention, the insulative layer, is made from an insulative material comprised of more than two organic resins having different dry etching rates. This is clearly described on page 7, lines 24-25 of the specification. This limitation is again described in the specification from page 11, line 26- page 12, line 1.

Page 12, line 25- page 13, line 7 discusses a simplified case of only two organic resins. However, a number of resins greater than a first resin 22 and a second resin 23 is preferably blended into the insulative layer so as to assure characteristics such as defoaming ability and leveling ability, in order to contrast or roughen the surface of the insulative layer by using differences of etching rates. The surface of the insulative layer shown in Figs. 2 and 3 is one typical example of a simplified embodiment using only two kinds of organic resins but claim 1 is directed to the preferred limitation of more than two kinds being employed.

It is Applicant's contention that one of ordinary skill would find the explanation relative to two organic resins as sufficient to simply repeat the disclosed procedure for more than two organic resins.

As stated in *In re Hayes Microcomputer Products, Inc.*, 25 USPQ2d 1241, 1246 (CAFC 1982)

An inventor is not required to describe every detail of his invention. An applicant's disclosure obligation varies according to the art to which the invention pertains.

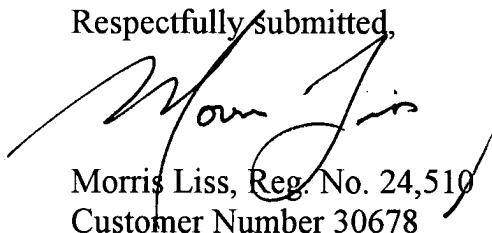
Applicant's description is believed to have met this obligation. The drawings show the feature of multiple organic resins. The claim sets forth a particular limitation of more than two such resins. A change to the drawings to merely show three resins instead of two is therefore unnecessary.

For the reasons set forth above, claim 1 is believed to be in condition for allowance.

In the event the Examiner believes an interview might serve to advance the prosecution of this application in any way, the undersigned attorney is available at the telephone number noted below.

The Director is hereby authorized to charge any fees, or credit any overpayment, associated with this communication, including any extension fees, to CBLH Deposit Account No. 22-0185.

Respectfully submitted,



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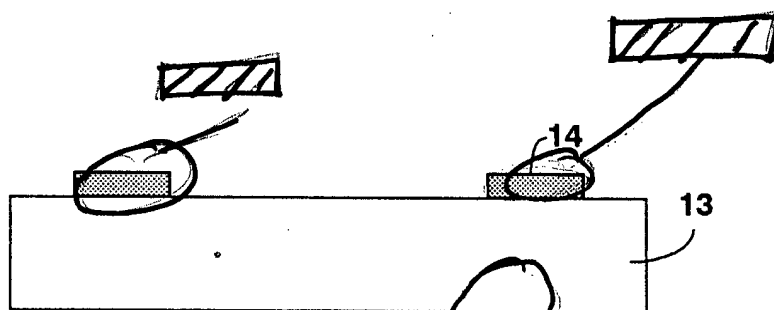


Fig. 1(a)

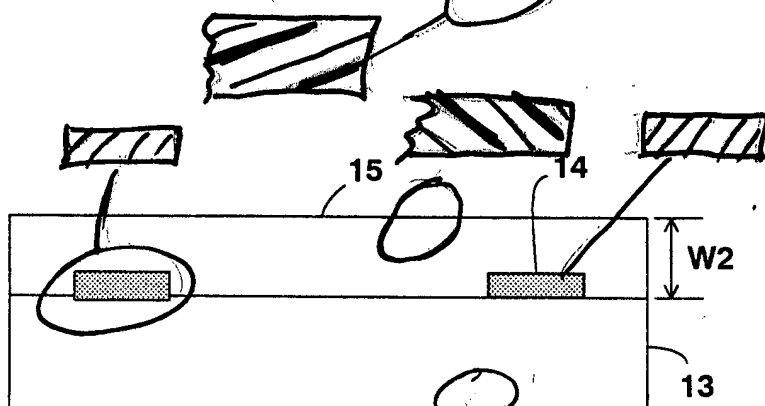


Fig. 1(b)

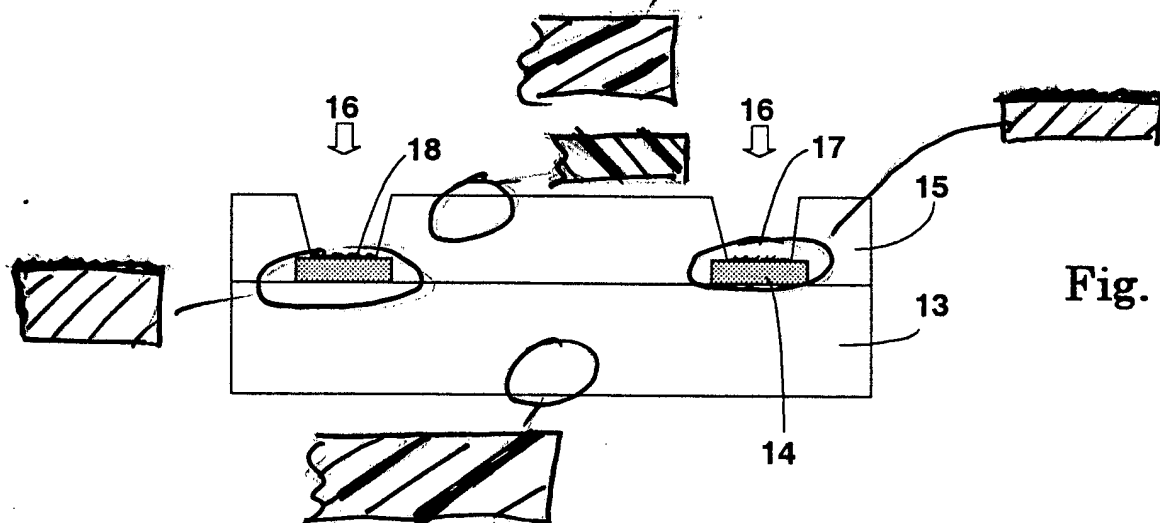


Fig. 1(c)

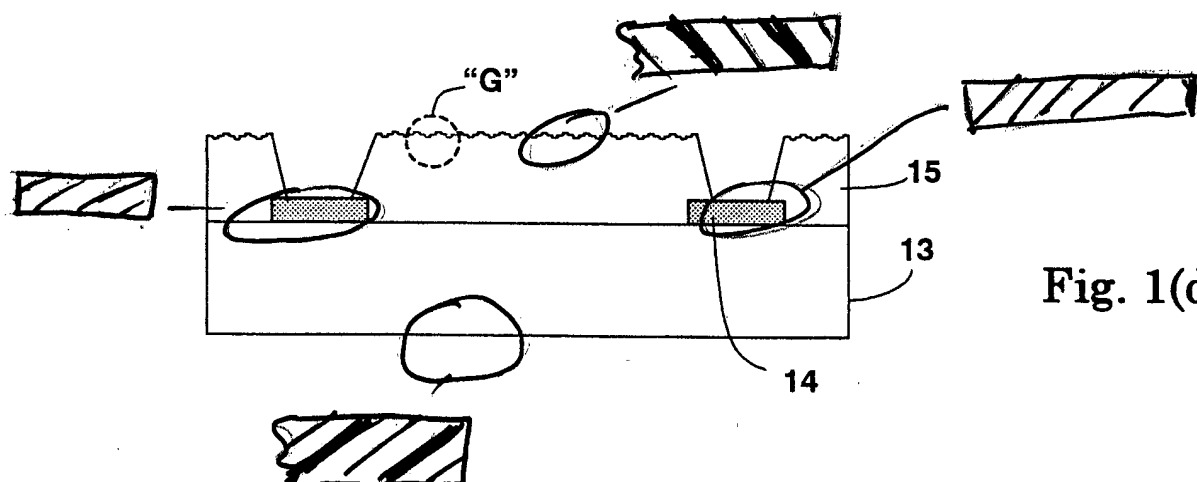


Fig. 1(d)

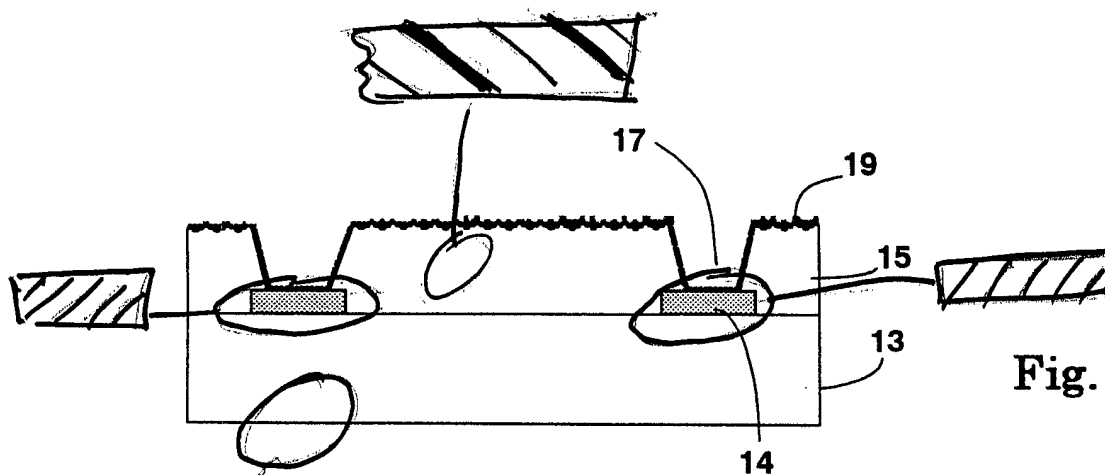


Fig. 1(e)

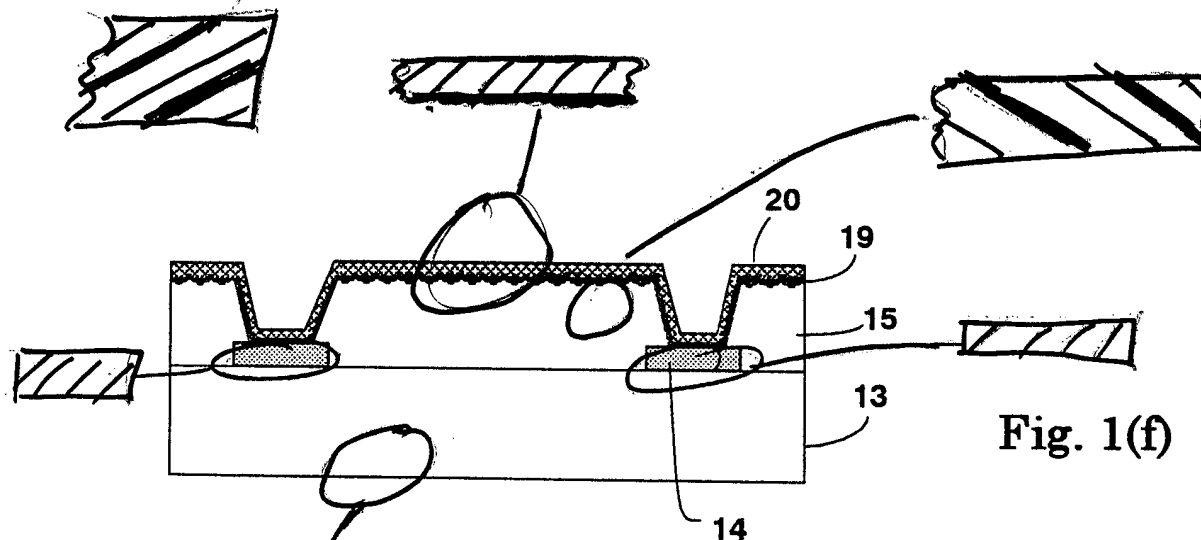


Fig. 1(f)

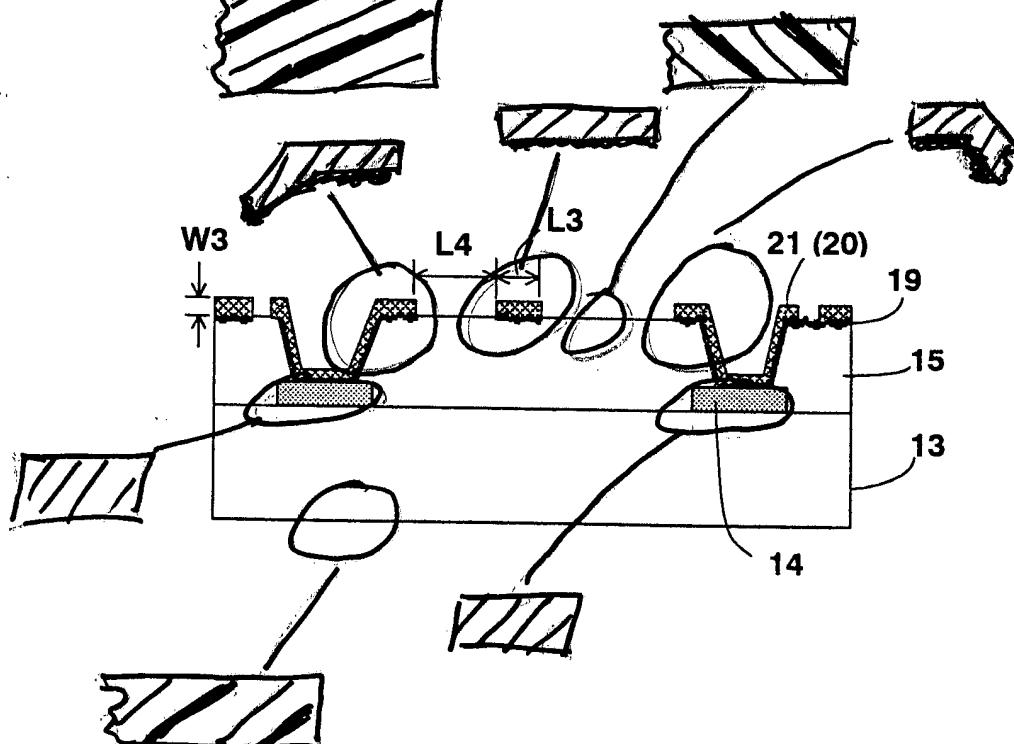


Fig. 1(g)

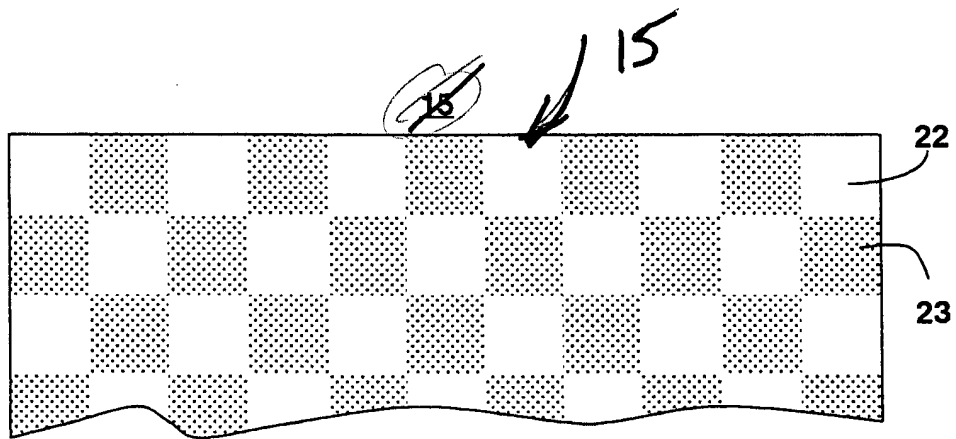


Fig. 2

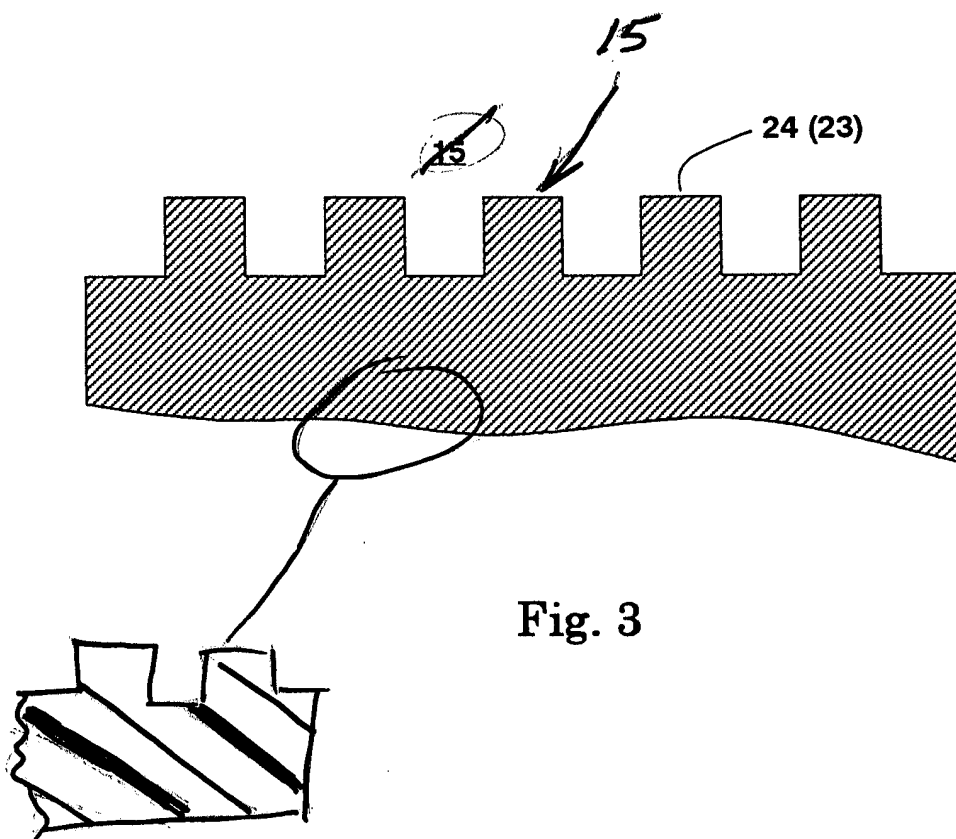


Fig. 3

Fig. 4(d)
Prior Art

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Prior Art

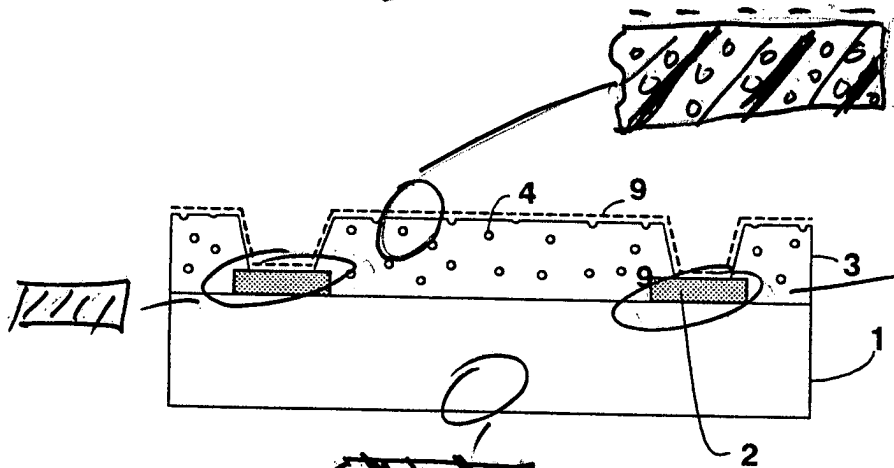


Fig. 4(e)
Prior Art

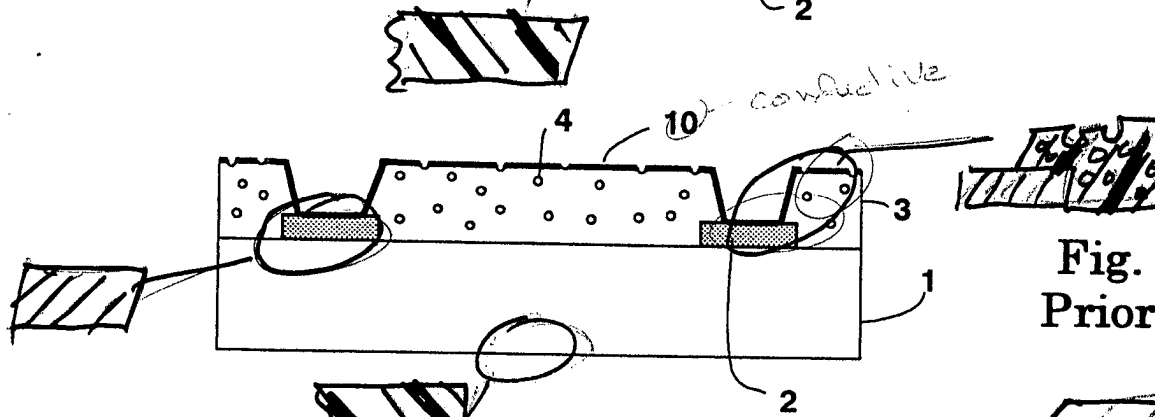


Fig. 4(f)
Prior Art

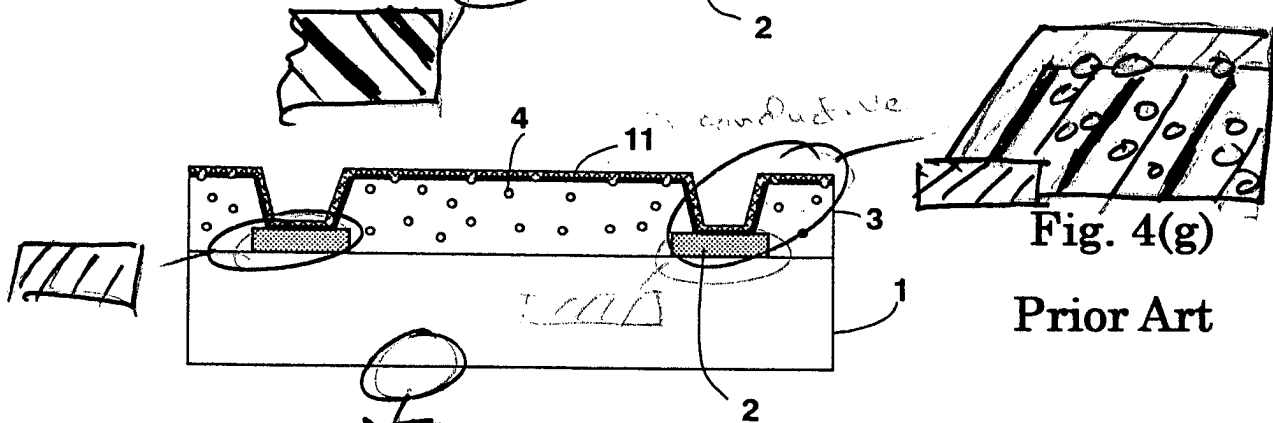


Fig. 4(g)
Prior Art

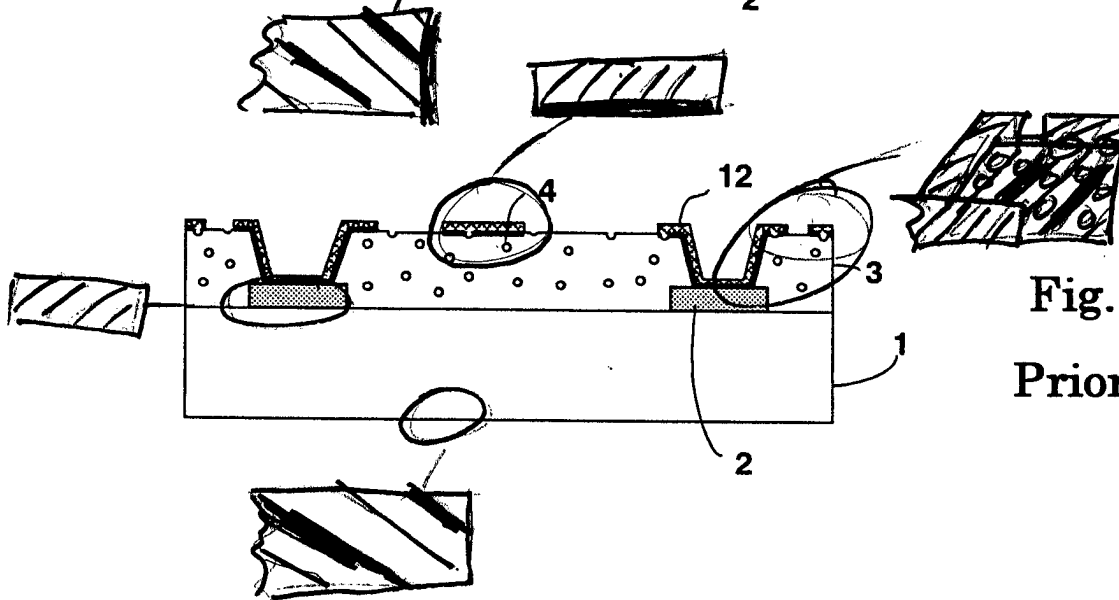


Fig. 4(h)
Prior Art